mately 40 per cent higher than the unlimed; that the oxidizing power varies inversely with its lime requirement; that nitrate accumulation and bacterial numbers were higher on the limed soils, whereas the ammonia accumulation was about the same for all of the plots; that the average crop yield for the past 10 years varies closely with the present oxidizing power of the soils; and that there is a noticeable correlation between crop yield, nitrate accumulation, and bacterial numbers, but not between crop yield and ammonia accumulation.

PARKER and TRUOG[4] find a rather close relation between the calcium and nitrogen content of plants. The contents of potassium, phosphorus, and magnesium do not bear this close relation to the nitrogen content. There are two groups of agricultural plants, those having a low calcium-nitrogen ratio and a low lime requirement, and those having a high calcium-nitrogen ratio and a higher lime requirement.—WM. CROCKER.

Arctic Caryophyllaceae.—A critical study of the morphology and ecology of the Caryophyllaceae is one of WARMING'S[5] most recent contributions to the science of ecology. He divides his report into four parts, dealing respectively with (1) morphology and vegetative propagation, (2) leaf anatomy, (3) adaptations to environment, and (4) flower biology and seed reproduction.

In the first section he recognizes and describes several growth forms, illustrating by drawings of typical plants and listing the species to be referred to each form. Numerous variations of the rosette and cushion forms are distinguished, and multiplication by buds, offshoots, runners, and layers is carefully discussed. The details of the leaf structure are to be obtained from the drawings, the most important generalization being the usual absence of xeromorphic features. Palisade tissue is poorly differentiated, the mesophyll has abundant large intercellular spaces, stomata usually occur on both surfaces, and the epidermis is thin-walled and but slightly cutinized, the leaves thus resembling those of hydrophytes or shade plants. In this respect they form a striking contrast with the xeromorphic leaves of the woody evergreens of the same regions.

Among the most conspicuous features of the flower biology is the common occurrence of both protandry and polygamy, the latter being accompanied by varying degrees of reduction of stamens in the ovulate flowers. Very frequently the corolla is decidedly smaller in the ovulate flowers.—GEO. D. FULLER.

Awn and barley yield.—HARLAN and ANTHONY[6] have found that early removal of the awns of barley greatly reduces the volume and dry matter of

[4] PARKER, F. W., and TRUOG, E., The relation between the calcium and the nitrogen content of plants and the function of calcium. Soil Science **10**:49–56. 1920.

[5] WARMING, ENG., The structure and biology of Arctic flowering plants. 13. Caryophyllaceae. Meddelelser om Grönland **37**:228–342. *figs. 44.* 1920.

[6] HARLAN, H. V., and ANTHONY, S., Development of barley kernels in normal and clipped spikes and the limitations of awnless and hooded varieties. Jour. Agric. Research **19**:431–472. 1920.

the kernels at maturity. The effect is not due to shock injury, for it does not manifest itself until at least a week after removal. The rachis of the clipped spikes contains about 25 per cent more ash than the unclipped. This is probably due to the fact that the awn when present is a great ash storage organ. The high ash content of the rachis probably accounts for the marked shattering in the clipped heads. The authors say: "Hooded and awnless barleys generally yield less and shatter more than awned varieties, and there seem to be physiological reasons for this fact." It may be possible to produce non-shattering hooded and awnless sorts by using parents which normally have a low percentage of ash in the rachises. It may also be possible to obtain strains that will give good yields under arid conditions. Under humid conditions it is likely that the objections to the awns are more easily met by the use of strains with smooth awns, which, so far as known at present, have no physiological limitations.—WM. CROCKER.

A subterranean algal flora.—MOORE and KARRER[7] have demonstrated the existence of a subterranean algal flora, independent of the terrestrial flora and to a great degree of the character and locality of the soil. The investigation included an analysis of a variety of soils collected in Missouri, California, and Massachusetts. The samples were collected at different depths under sterile conditions and in localities where the soil had not been disturbed for a number of years. These were placed in bottles containing an amount of sterile algal nutrient solution and sterile sand. The growth was examined at the end of several weeks, and in this manner the algae which occurred in small amounts could easily be studied. From these investigations it was shown that algae exist in the soil to a depth of 1 m. at least under conditions which preclude the possibility of surface infection. A wide variety of species was not found, but of particular interest is the fact that *Protoderma viride* (Kützing) occurred at all depths and in all the samples obtained in the widely separated localities.—JOANNE KARRER.

Odor constituents of apples.—POWER and CHESTNUT[8] have found that the odor constituents of apples consist essentially of amylesters of formic, acetic, and capsoic acids, with a very small amount of caprylic ester and a considerable proportion of acetaldehyde. The acids mentioned are probably present also in the free state. These essential oils constitute only about 0.0007–0.0013 of 1 per cent of the weight of the entire ripe fruit. "Although amyl valerate is generally designated in chemical literature as 'apple oil,' it is quite certain that this compound has never been identified as a constituent of apples." The difference in odor of various apples is due to the difference in proportions of the oils mentioned.—WM. CROCKER.

[7] MOORE, G. T., and KARRER, JOANNE L., A subterranean algal flora. Ann. Mo. Bot. Gard. **6**:281–307. 1919.

[8] POWER, F. B., and CHESTNUT, V. K., The odorous constituents of apples; emanation of acetaldehyde from the ripe fruit. Jour. Amer. Chem. Soc. **42**:1509–1526. 1920.